Smart Beta: Managing Diversification of Minimum Variance Portfolios

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Discussion – Marie Brière

QMI Conference - Imperial College London - 4 Nov 2015
The paper in brief

- Paper proposes a unified framework to understand risk-based portfolios
  - Global minimum variance (GMV)
  - Equal weight (EW)
  - Equal risk contribution (ERC)
  - Max diversification portfolio (MDP)

- These portfolios are special cases of a volatility minimization problem with different diversification constraints
  - GMV: only budget constraint
  - EW: add Herfindahl index « weight diversification » constraint
  - ERC: add « risk contribution diversification » constraint
  - MDP: « diversification ratio » constraint

- Constraints can be relaxed by changing the values of c1, c2 and c3
The paper in brief

- Characterizes the tradeoff between (1) portfolio volatility, (2) the 3 different forms of “diversification”, (3) deviation to the cap weighted index (TE or beta)
  - Each « smart beta » strategy targets a different level of volatility reduction
  - When adjusting the constraint to target the same level of volatility, the portfolios become comparable

- Proposes a unified optimization framework allowing to mix the diversification constraints
  - Two parameters to control the tradeoff between the different forms of diversification
  - A third parameter to control for TE

- Examines the out of sample performances of smart beta portfolios during bull and bear markets and proposes dynamic smart beta rebalancing strategies depending on market conditions
  - Bull market: high diversification
  - Bear markets: high volatility reduction
General comments

- Very nice, clearly written paper

- Tackles a very interesting question, important for practitioners: the tradeoff between mean-variance efficiency and “diversification”
  - Portfolios constructed using sample moments often involve very extreme positions, practitioners do not like it!

- Provides very useful results
Background

What is the relationship between “weight diversification” and mean-variance efficiency?

- Mean-variance efficient portfolios are not necessarily well diversified
- Mean variance CAPM requires diversification only if the market cap weighted ptf is diversified
- Black and Litterman (1990): extreme weights generated by asset allocation models are a major obstacle to implementation
- Practitionners suspicious of ptf not naively diversified: very often implement weight constraints to force diversification (success of 1/N ptf, etc.)

All this justifies the interest of introducing a diversification constraint in ptf optimization techniques, but what is precisely the objective?
Questions

Q1: Why a diversification constraint?

- Hypothesis 1: Reduce the estimation error

- The investor cares only about volatility reduction – diversification constraints are here only to help achieving efficient volatility reduction out of sample

Csq: the portfolios should be evaluated out of sample on their volatility reduction compared to the GMV (and not the market cap portfolio)

- If extreme weights are due to estimation errors in the sample moments, then adding diversification constraints should help

- If extreme weights are due to the characteristics of the asset returns’ moments, then diversification constraints will not add much

- It would be interesting to know!
Questions

Q1: Why diversification constraints?

- Hypothesis 2: This is part of the investor’s objectives

- Having low diversification is a problem per se for the investor and should enter the objective function of the investor

Csq: the portfolio should be evaluated in sample but also out of sample on the corresponding diversification measures as well

- This is lacking in the paper: we only have a comparison of volatility reduction / TE (fig 2.10 & 2.11)

- Add the risk diversification / diversification ratio out of sample measures
Questions

Q2: Evaluation of the smart beta strategies

Is volatility the best measure to consider to assess the portfolio risk?

– We know that naive diversification strategies like 1/N increase tail risk and make ptf returns more concave relative to MC ptf because it is similar to a conservative long term asset mix (buy equities as equity market falls and sell them when it rises).

– Manipulation-proof performance measures (Goetzmann et al., 2007) ?

Other criterias to evaluate the portfolios?

– Table 2.5 shows that when adjusting the diversification constraints to achieve the same level of volatility reduction, the 3 diversification constraints become comparable, returns are highly correlated across diversification stratgeies

– Other criteria needed to assess the ptf ?

– Distance to the efficient frontier? Horizontal or vertical distance (Basak et al., 2002 ; Brière et al., 2013), Turnover of the portfolios ?
Q3: Could we try to characterize the tradeoff between volatility reduction and diversification?

- Green and Hollified (JoF 1992) show that extreme weights in minimum variance portfolios are due to the dominance of a single factor in the covariance structure of returns, this creates high correlation between naively diversified portfolios

- Csq: If one single factor dominates, using a diversification constraint might not be a good idea

- We will loose a lot in terms of volatility by forcing a certain level of diversification

Could be interesting to examine the dispersion of individual assets beta in the different universe as a factor explaining the tradeoff between volatility reduction and diversification

- For ex: Emerging markets: strong beta dispersion, less concentrated portfolios (there is more « natural » diversification), the diversification constraint should penalize less than for a small universe (Eurostoxx 50) much more concentrated
Questions

Q3 (ctnd): Could we try to characterize the tradeoff between volatility reduction and diversification?

- Seems to be true from Fig 2.11: when imposing same equal weight constraint to all indices, volatility increase depends on the universe

- Related to the beta dispersion

<table>
<thead>
<tr>
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<th>Average volatility reduction</th>
<th>volatility increase from GMV to EW</th>
<th>beta dispersion</th>
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- This tradeoff might be different for alternative « diversification constraints », also involving the volatilities
Questions

Q4: Next step? Mean variance framework with a diversification constraint? Introducing expected returns?

Alternative way to present the results?

- present the optimisation problem as a multi-criteria optimisation problem like portfolio optimization with skewness, kurtosis etc.

- Different levels of risk aversion to the different diversification measures (see Jondeau and Rockinger EFM 2006 for ex)

- Build a 3-dimensions efficient frontier (risk, return, diversification) allowing to represent the tradeoff between risk/return and diversification
C1: Why does the « max diversification » constraint appear in the budget constraint and not in the diversification constraint?

- We could have a diversification constraint with 2 parameters representing the tradeoff between the 3 types of diversification constraints.

\[
D(x; \gamma) = \gamma \sum_{i=1}^{n} \ln x_i - (1 - \gamma) \sum_{i=1}^{n} x_i^2
\]

\[
B(x; \delta) = \delta \sum_{i=1}^{n} x_i + (1 - \delta) \sum_{i=1}^{n} x_i \sigma_i
\]
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